Journal
of
The Franklin Institute
Devoted to Science and the Mechanic Arts

Vol. 253 APRIL, 1952 No. 4

RADIO'S MEMORABLE ANNIVERSARY *

BY

THOMAS COULSON[1]

From the dawn of history the two principle agencies for the dissemination of knowledge have been books and communication methods. Once writing was established, its methods of preservation underwent continuous improvement until the invention of printing made the multiplication of books a relatively simple and popular means for the diffusion of knowledge. Yet, other means of communication remained stationary for centuries. The methods available to the founders of the American Republic were substantially the same as those used in Biblical times.

The Nineteenth Century was to witness greater technological advances than any previous period of similar length, and it is not surprising to learn that existing methods of communication were improved and new ones introduced. First, came the semaphore for visual signalling, which reduced the time required for transmitting messages over short distances; then came the electric telegraph to extend the area which could be covered; and finally, came the telephone for the transmission of speech over longer distances. At the close of this century man was enjoying communication facilities undreamed of by the Founding Fathers. There seemed nothing further to discover or invent which would lead to the quickening of transmission or its diffusion over a wider area.

As the century drew toward its close a few scientists were experimenting with the electrical waves which Clerk Maxwell had said could travel through the air with the same speed as light. Maxwell did not produce any such waves, but he said they were there and one day an

---

* From the talk presented on the General Electric Science Forum Program, over WGY, Schenectady, December 12, 1951, honoring the 50th anniversary of trans-Atlantic radio.

[1] Director of Museum Research, The Franklin Institute, Philadelphia, Pa.

(Note—The Franklin Institute is not responsible for the statements and opinions advanced by contributors in the JOURNAL.)

experimenter would find them. Heinrich Hertz found them twenty-three years later in his laboratory at Bonn, and his discovery inspired a number of other scientists to pursue the study. Although there were several improvements in the crude apparatus devised by Hertz there was no indication in the results obtained that would induce anyone to proclaim that the world had arrived at the eve of a new era in communication.

The trans-Atlantic cable by which means of rapid communication was conducted between the New World and the Old had been regarded as an engineering triumph—and rightly so. It represented a vast organization of many skills and much capital, and it reflected the infinite patience of man in overcoming technical and natural obstacles. The cable was such a noteworthy advance upon any preceding trans-oceanic method of communication that users were willing enough to overlook any of its deficiencies. Even when this continent and Europe had been connected by cable, messages were frequently delayed because of the limited capacity of the cable to carry them; and, when the distant end of the cable had been reached, the messages had to be relayed over thousands of miles of wire stretching in all directions. To convey an important news item to the capitals of Europe, implied the dispatch of as many telegrams as there were capitals. Many places remained inaccessible to the receipt of rapid delivery because no wire reached them. Nor could anything moving, as a ship, be reached. Travellers by sea had to reconcile themselves to isolation from the rest of the world until they arrived at some port.

Although the sparks produced by Hertz oscillators were to be heard crackling in many laboratories in Europe and America, the resonators for receiving them at a distance were not sufficiently sensitive to inspire any grand hopes of achieving widespread broadcasts over long distances in the immediate future. The possibility that these sparks might emerge into the nucleus of an entire new conception in the realm of instruction and entertainment had not occurred to the most optimistic investigator. In the '80's even the scientific world had been so skeptical about the idea of electromagnetic waves traversing space, that David Edward Hughes, who had demonstrated a microphone before the Royal Society in London, was so discouraged at being unable to convince his fellow scientists of the truths of these waves, that he refused to read a paper on the subject. Twenty years later, the waves were not only accepted as practical, but they were being transmitted and received in many laboratories over distances measured in feet. In February, 1896, Guglielmo Marconi appeared to be in advance of the movement when he took out the first British patent on wireless telegraphy. Four years later, he had succeeded in transmitting signals from St. Catherine's Point, on the Isle of Wight, to the Lizard in Cornwall, a distance of 198 miles. This represented rapid progress, and the success inspired him with the hope that he might be able to transmit and receive messages across the Atlantic Ocean.

This conception was so much bolder even than the trans-Atlantic cable that it bordered on the fantastic. Instead of proposing to have a single channel over which messages could be passed for distribution over a vast network of wires, it was proposed to disseminate messages instantly in all directions over the entire world.

Such an enormous expansion of communications as this promised to be was a grotesque proposal to offer to a world educated to the marval of the restricted trans-oceanic cable. It was such a daring enterprise, charged with so many problems and hazards and intangibles that the young inventor decided to forego the fanfares, flagwaving, and banquets that had marked the opening of the Atlantic cable. He was by no means sure of success, but he was inspired by a faith, a boundless faith, that patient and painstaking investigation would reveal many unsuspected secrets in these mysterious electric waves. He was already becoming accustomed to seeing public inertia break down before the demonstrations of their practical applications.

Some of the experts of the Signal Corps as well as the general public had scoffed at the contention that these electromagnetic waves would pass through buildings and mountains, but demonstrations had convinced them of their error. Sailors, more than anyone else, wanted a method of communication which would enable them to keep in touch with the shore, but invisible waves did not appear to be the solution to their problem. How could they penetrate a fog? Or fail to lose direction in darkness? Being released indiscriminately into the air, the waves would be distorted and dispersed by storms. Demonstrations had proved these fears to be false, and most of the wireless experiments were conducted between ship and shore, or between ships in motion. But formidable obstacles still loomed before wireless telegraphy over great distances came within the bounds of probability.

Marconi had built a transmitting station at Poldhu, in Cornwall, England, and he contemplated erecting a receiving station somewhere on the North American continent. Regarding the location of these two points on a terrestrial globe showed clearly enough that the curvature of the earth would raise a gigantic wall of water between them. The factor around which most speculation centered was whether the electrical waves could penetrate this water barrier or whether they would follow the curvature of the earth. Neither seemed at all probable. Even if the water proved to be no barrier, the probability was that the waves would glide off into space.

However, encouraged by his small success in receiving signals over a distance of nearly 200 miles, Marconi resolved upon making the experiment of trying to receive them over ten times that distance. He had no theoretical knowledge to guide him, nor had anyone else, so that he had no alternative but to set up an American station and make the test. Satisfied that the Poldhu station would serve for the transmitter, he proposed to build the receiving station at Cape Cod, Mass. At each station a ring of masts, 200 ft. high, supported the aerial wires, which were brought in to the apparatus in the center of the ring. In September, 1901, the Poldhu aerial was blown down by a gale. Two wooden masts, 170 ft. high, were hastily substituted, with a fan-shaped aerial hung between them. In November, the Cape Cod aerial was blown down.

When Marconi sailed for America with these disasters fresh in mind, he might very well have been pardoned if he had allowed his thoughts to linger pessimistically over the misfortunes which had attended the laying of the Atlantic cable. He may have recalled how the cable had broken several times, provoking months of delay. Then, after the cable had been successfully laid, the electric impulses had failed to make their way over it. The project was abandoned for seven years before it was resumed. Marconi could have anticipated that his own enterprise might encounter a similar series of unpredictable frustrations and delays before success was realized.

Yet, within six days of landing he had established a receiving station on the summit of Signal Hill, overlooking St. John's harbor, Newfoundland. He had abandoned his thought of having an elaborate ring of masts to support an aerial, and hoped to achieve parallel results with the aid of some balloons and kites he had brought for the purpose. The balloons were found to be unmanageable in the turbulent December air, but a kite was flown from which the receiving aerial, about 500 ft. long, was suspended. This aerial was secured to a mast and connected by a wire to the receiving apparatus. A self-restoring coherer (Marconi's own improvement upon Branly's original coherer) and a pair of telephones formed part of the apparatus. The latter were preferred to the usual arrangement of having the coherer signals recorded automatically on paper tape through a relay and Morse instrument. The human ear, being more sensitive than the recorder, would pick up faint signals to which the mechanical device might not respond.

Marconi had arranged with J. A. Fleming (later better known as Sir Ambrose), who was in charge of the Poldhu station, for signals to be transmitted at a certain speed and at certain hours on receipt of a message announcing that the receiving set was in readiness. On December 11, 1901, Marconi dispatched a cable giving instructions for the transmission to start at noon on the following day.

As the clock moved toward mid-day on Thursday, December 12, Marconi took his seat at the receiving apparatus with a telephone at his ear. At such a dramatic moment one would have expected an audience to have assembled, waiting with suppressed excitement for the outcome of the experiment. In point of fact, Marconi and his two assistants were alone. The experimenter was a shy reserved man who shunned publicity unless he had some definite statement to make. He had no desire to suffer public discomfiture over the crucial experiment on which hinged new and revolutionary communications among all nations on earth. If his conception of trans-oceanic wireless should collapse like a bubble the failure could do irreparable harm to the infant science and to the commercial company he had recently formed to exploit it. Practical wisdom dictated silence in England, but the matter could not be held in secret in a small community like that of St. Johns, where the flying in midwinter of balloons and kites was not an everyday occurrence. However, no curious observer climbed the snow covered slope of Signal Hill that day.

At twelve o'clock Marconi began listening for his signal. For half an hour he listened and heard—nothing. He began groping through the air for the English signal. He had no calibrated dial such as we have today on our radio sets for locating a desired station. There would have been no advantage in having one, since he did not know the wave measurement of the Poldhu transmitter. There was no device by which the wave could be measured. So Marconi had to search through space for his signal.

He listened and listened. Not a sound could he detect. He inspected his instrument and found it was perfect. Had something gone wrong in Poldhu to interfere with transmission? He resumed listening but again without result. Doubts began to assail him. Was the curvature of the earth an insurmountable barrier? Had he not been too optimistic in supposing that an invisible wave could travel through the air across an ocean and find a single copper wire dangling from a kite nearly 2000 miles away? There appeared substantial reasons why the electromagnetic waves should never reach St. Johns, and only very slender hopes that they might.

He patiently resumed his blind tuning in search of the elusive signal. After another half an hour of searching he thought he detected a sound. Listening intently he imagined this sound was repeated, three short dots—the letter S in Morse code. It was the prearranged signal. Marconi was receiving the first wireless signal that had traversed the Atlantic.

How did he take it? Remember this young man (he was only twenty-seven years old) was the son of an Italian father and an Irish mother, a combination which gave promise of offspring with ebullient natures. No one would have been astonished had there been a violent commotion on the top of Signal Hill that afternoon. But all was calm and still. In recalling that thrilling moment some time later, Marconi said: "I could not be satisfied without corroboration. 'Can you hear anything, Kemp?' I said, handing the receiver to him. Kemp heard the same thing I did, and I knew I had been absolutely right in my anticipation."

That was all. No elation, no exultation, no jubilant telegrams fired off in all directions to the press. So far as we know there was not even an extra glass of wine at dinner that night.

Next day, Marconi and Kemp took up their listening again. They could hear nothing but those three dots, repeated with monotonous regularity. But could any music have sounded sweeter? There was only one radio station in the world which could be sending out that signal. Distance had been annihilated, the electromagnetic waves were passing serenely around the earth, the skeptics would be confounded. All that was now required to make wireless telegraphy a practical commercial enterprise was the refinement and improvement of the sending and receiving apparatus.

The history-making experiment, headline stuff for the newspapers, was not immediately announced to the world. Marconi kept it secret until he learned what another day might bring forth. When the next day's experience provided confirmation of their success, he issued a restrained statement in which he characteristically went out of his way to pay a tribute to the men whose earlier discoveries had paved the way for his investigations. The news reached New York on a peaceful Sabbath morning. Instantly reporters were rushing helter-skelter northward to get the story from the young man who had made a vision become a reality. The gist of the reports they sent back was that the visionary had spent $200,000 in sending three dots across the Atlantic. Even at that price they were cheap.

That was fifty years ago. The old sparks no longer crackle in the transmitting rooms. Their place has been taken by softly glowing tubes that silently convey their messages. Science moved much too quickly for radio to remain long unchanged. Anything that will transmit light and sound through space must necessarily have a multiplicity of uses. Enlivened by constant progress, refreshed by invention, radio retains a youthful vigor, but as changes come and the substituted parts are laid aside, as we learn the new names which progress brings, one name must remain outstanding, the name of the young man with a faith and vision—Guglielmo Marconi.